THARSIS-CENTERED AND OTHER FAULT ACTIVITY IN THE THAUMASIA REGION, MARS, BASED ON DETAILED MAPPING AND GIS ANALYSIS. J. M. Dohm, K. L. Tanaka, and T. M. Hare, U.S. Geological Survey, Flagstaff, AZ, 86001; jdohm@flagmail.wr.usgs.gov

INTRODUCTION. Regional and local centers of volcanic and (or) tectonic activity, which largely includes Tharsis, produced small and large extensional and compressional structures in the Thaumasia region mainly during the Noachian and Hesperian Periods [1,2]; the structural deformation in the region is without parallel on Mars in both complexity and diversity. An intensive study of the faults and grabens in Thaumasia was undertaken to determine their causal, temporal, and spatial relations with the surrounding geology and other structures. We mapped and dated (by stage; see [2]) thousands of faults and grabens and other tectonic and erosional structures as part of a comprehensive, multilayered Geographic Information Systems (GIS) database of geologic, paleoerosional, and paleotectonic information for comparative analysis [2-4]. The primary focus of this abstract is Tharsis-centered activity (intensity and duration) that formed faults and grabens of Claritas Fossae in the northwest part of the Thaumasia region.

METHODOLOGY. We digitized 14,047 faults and grabens in the Thaumasia region; each digitized structure is a polyline made up of one or more connected linear segments of varying trends. Next, we defined the mean orientation of each fault by averaging the trends of each segment (weighted by segment length). We then partitioned the faults of Claritas Fossae in northwestern Thaumasia for detailed study (Fig. 1). There, we separated the structures having Tharsis-centered trends from those that appear to be related to other volcanotectonic centers. The Tharsis faults fan to the south (Fig. 1), requiring that we include increasingly greater ranges of fault trends southward. We accommodated the fanning orientations by dividing the study region into five latitudinal bands. Our tests show that reasonable variations in the assigned orientation ranges produced only modest changes in the number of faults (< 5%). After the range of fault orientations most appropriate for Tharsis was determined for each band, we measured the total number and length of Tharsis-centered faults in Claritas Fossae and determined their areal density for the major stages of geologic activity.

RESULTS . Our analysis of faults and grabens of the entire Thaumasia region indicate that tectonic activity began and reached its peak during the Noachian and declined substantially during the Hesperian and Amazonian [5]. These results are in general agreement with previous work [6] but provide more temporal, spatial, and geologic detail. Our study of Claritas shows that the fault system has the most numerous, densest, and longest lived system of faults in the region. At Claritas Fossae, Tharsis-centered faulting probably commenced in the Early to Middle Noachian (stage 1), declined during Late Noachian and Early Hesperian (stages 2 and 3), and experienced only minor Late Hesperian/Amazonian regional faulting (during stage 4; see Fig. 2). The waning of Tharsis-centered tectonism is coeval with the emplacement of large volumes of Tharsis- and Syria-related lava flows; thus a significant change from tectonic to volcanic Tharsis-dominated activity occurred during the Late Hesperian (stage 4). The decline in Tharsis-radial normal faulting may correspond with a decline in intrusive thickening of the crust at Tharsis [7].

Other significant Tharsis-centered structures occur in Thaumasia Planum (south of Coprates Chasma) and elsewhere, including radial faults and grabens that parallel Valles Marineris and wrinkle ridges that are mainly concentric to Syria Planum. In Sinai Planum, undeformed Late Hesperian lava flows (stage 4) bury Early Hesperian ridged plains material (stage 3) that in turn buries an older (stage 2), eastern ridged plains unit of Thaumasia Planum and its associated structure. These relations indicate a sharp decline of Tharsis-centered normal faulting and compressional deformation during the Early to Middle Hesperian for the northeastern part of the Thaumasia region.

REFERENCES. [1] Dohm et al. (1994) *LPSC Abs. 25*, 331. [2] Dohm, J.M. and Tanaka, K.L. (1996) *LPSC Abs. 27*, 315. [3] Dohm et al. (1996) *GSA Abs. 28*, A-128.[4] Dohm et al., *this volume (channel development abstract).* [5] Dohm et al. (*map in preparation*) Geologic, Paleotectonic, and Paleoerosional Maps of the Thaumasia Region, Mars. [6] Scott, D.H. and Dohm, J.M. (1990) *LPSC Proc. 20*, 487. [7] Tanaka, K.L., et al. (1991) *JGR 96*, 15,617.

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Figure 1. Paleotectonic map of the northwest Thaumasia region. Claritas Fossae area, outlined by bold lines, used in fault statistics. Non-Tharsis-related structures and geologic units are subdued.

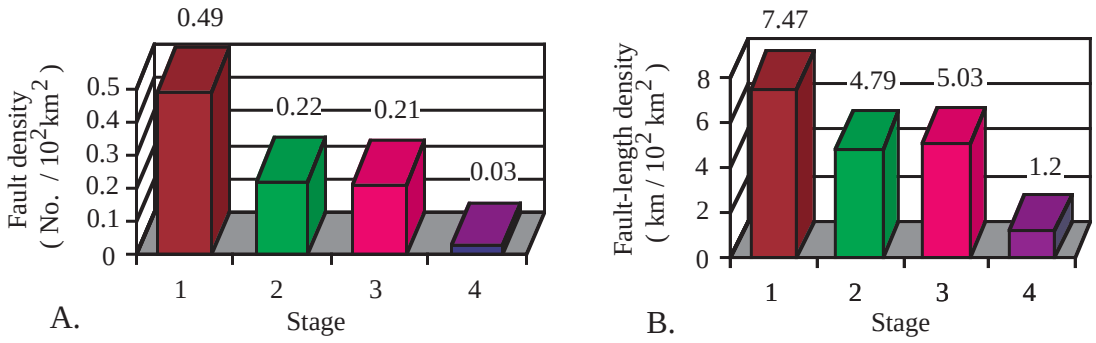

Figure 2. Histograms showing the densities per stage of the (A) number of faults and (B) total fault length of Claritas Fossae of the Thaumasia northwest region. Data from [5].